WHAT IS CLAIMED IS:

1. A method for forming a silicon carbide film on a semiconductor substrate by plasma CVD, comprising the steps of:

(a) introducing a raw material gas containing silicon, carbon, and hydrogen and an inert gas at a predetermined mixture ratio of the raw material gas to the inert gas into a reaction chamber;

(b) applying radio-frequency power to a reaction zone inside the reaction chamber at the mixture ratio, thereby forming on a semiconductor substrate a curable silicon carbide film having a dielectric constant of about 4.0 or higher; and

(c) continuously applying radio-frequency power to the reaction zone at a mixture ratio which is reduced from that in step (b), thereby curing the silicon carbide film to give a dielectric constant lower than that of the curable silicon carbide film.

2. The method according to Claim 1, wherein the cured silicon carbide film has a stress change in the atmosphere or at 400°C which is about less than 1/2 of that of the curable silicon carbide film.

3. The method according to Claim 1, wherein the silicon carbide film is made of a Si-C-H material.

4. The method according to Claim 1, wherein the reduction of the mixture ratio is accomplished by (i) decreasing the flow rate of the raw material gas, (ii) increasing the flow rate of the inert gas, or (iii) both decreasing the flow rate of the raw material gas and increasing the flow rate of the inert gas.

5. The method according to Claim 4, wherein the mixture ratio is constant before and after a point where the mixture ratio is discontinuously reduced.

6. The method according to Claim 4, wherein the mixture ratio is constant before a point where the mixture ratio is reduced, and the mixture ratio is continuously reduced after the point.

7. The method according to Claim 1, wherein the mixture ratio of the raw material gas to the inert gas before the reduction, is about 1/1 to about 1/3.

8. The method according to Claim 1, wherein the mixture ratio of the raw material gas to the inert gas after the reduction, is about 1/5 to about 1/100.

9. The method as claimed in Claim 1, wherein the mixture ratio of the raw material gas to the inert gas after the reduction, is about zero.

10. The method according to Claim 1, wherein the raw material gas comprises tetramethylsilane, trimethylsilane, and/or divinyl-dimethylsilane.

11. The method according to Claim 1, wherein the inert gas comprises helium, argon, neon, xenon or krypton.

12. The method according to Claim 1, further comprising stabilizing the reaction zone prior to the film formation, wherein the flow rate of the raw material gas and the flow rate of the inert gas are increased from zero until reaching a predetermined mixture ratio by a ramp-up method.

13. The method according to Claim 1, wherein the radio-frequency power is comprised of low frequency power and high-frequency power.

14. The method according to Claim 13, wherein the low frequency power is power having a frequency of less than 2 MHz and high frequency power is power having a frequency of no less than 2 MHz.

15. The method according to Claim 1, wherein a time period for the curing is about 5 seconds to about 10 seconds per the curable silicon carbide film having a thickness of about 20 nm to about 100 nm.

16. The method according to Claim 1, wherein the flow rate of the raw material gas and the flow rate of the inert gas before the reduction of the mixture ratio are about 100 sccm to about 1,000 sccm and about 100 sccm to about 3,000 sccm, respectively.

17. The method according to Claim 1, wherein the silicon carbide film is an etch stop film.

18. The method according to Claim 1, wherein in step (a), in addition to the raw material gas and the inert gas, a hydrogen source gas is introduced into the reaction chamber.

19. The method according to Claim 18, wherein in step (c), the hydrogen source gas flow is changed by synchronizing the hydrogen source gas flow with the raw material gas flow.

20. The method according to Claim 18, wherein in step (c), the hydrogen source gas flow is reduced from that in step (b).

21. The method according to Claim 20, wherein the hydrogen source gas flow is reduced to about zero at the end of step (c).

22. A method for forming a silicon carbide film on a semiconductor substrate by plasma CVD, comprising the steps of:

forming a curable silicon carbide film having a dielectric constant of more than about 4.0 on a semiconductor substrate placed in a reaction chamber, by introducing a raw material gas containing silicon, carbon, and hydrogen at a given flow rate, and an inert gas at a given flow rate into the reaction chamber, and applying radio-frequency power to a reaction zone inside the reaction chamber; and

curing the silicon carbide film to give a dielectric constant of no more than about 4.0 by discontinuously or continuously reducing and then maintaining a mixture ratio of the raw material gas to the inert gas while continuously applying radio-frequency power to the reaction zone.

23. The method according to Claim 22, wherein the reduction of the mixture ratio is accomplished by (i) decreasing the flow rate of the raw material gas, (ii) increasing the flow rate of the inert gas, or (iii) both decreasing the flow rate of the raw material gas and increasing the flow rate of the inert gas.

24. The method according to Claim 22, wherein the mixture ratio is constant before and after a point of the mixture ratio's discontinuous reduction.

25. The method according to Claim 22, wherein the silicon carbide film is an etch stop film.

26. The method according to Claim 22, wherein in step (a), in addition to the raw material gas and the inert gas, a hydrogen source gas is introduced into the reaction chamber.

27. The method according to Claim 26, wherein in step (c), the hydrogen source gas flow is changed by synchronizing the hydrogen source gas flow with the raw material gas flow.

28. The method according to Claim 26, wherein in step (c), the hydrogen source gas flow is reduced from that in step (b).

29. The method according to Claim 28, wherein the hydrogen source gas flow is reduced to zero at the end of step (c).

30. A method for forming a silicon carbide film on a semiconductor substrate by plasma CVD, comprising the steps of:

(A) introducing a raw material gas containing silicon, carbon, and hydrogen, a hydrogen source gas, and an inert gas at a predetermined mixing formulation of the raw material gas, the hydrogen source gas, and the inert gas, into a reaction chamber;

(B) applying radio-frequency power to a reaction zone inside the reaction chamber at the mixture ratio, thereby forming on a semiconductor substrate a curable silicon carbide film; and

(C) continuously applying radio-frequency power to the reaction zone at a mixing formulation wherein the hydrogen source gas flow is reduced from that in step (B), thereby curing the silicon carbide film to give a dielectric constant and leakage current lower than those of the curable silicon carbide film.

31. The method according to Claim 30, wherein the radio-frequency power is comprised of low frequency power and high-frequency power.

32. The method according to Claim 31, wherein the low frequency power is less than about 1/2 of the total power.

33. The method according to Claim 30, wherein the hydrogen source gas flow is about 10 sccm to about 5,000 sccm in step (B).

34. The method according to Claim 30, wherein the hydrogen source gas flow is about 0 sccm to about 1,000 sccm in step (C).

35. The method according to Claim 30, wherein step (C) is conducted for about 5 seconds to about 10 seconds.

36. A method for forming an interconnect on a semiconductor substrate by plasma CVD, comprising the steps of:

forming a dielectric film on a semiconductor substrate using a gas containing silicon, carbon, oxygen, and hydrogen and optionally an inert gas by plasma CVD;

forming as an etch stop layer a silicon carbide film on the dielectric film according to Claim 1; and

subjecting the substrate to etching for copper wiring.

37. The method according to Claim 30, wherein the dielectric film is made of a Si-C-O-H material, and etch stop layer is made of a Si-C-H material.

38. A method for manufacturing on a semiconductor substrate an interlayer structure containing a film in contact with a copper layer, comprising the steps of:

(i) forming multiple layers on a semiconductor substrate;

(ii) forming a hole for an interlayer connection of the multiple layers by etching;

(iii) depositing copper in the hole;

(iv) removing an excess of the copper from a top of the multiple layers;

(v) depositing a silicon carbide film on the top of the multiple layers according to Claim 30, whereby the copper is covered by the silicon carbide film.

39. The method according to Claim 38, wherein in step (i), the multiple layers comprise a lower etch stop layer, a lower low dielectric layer, an intermediate etch stop layer, an upper low dielectric layer, and an upper etch stop layer laminated in sequence on the substrate, and in step (ii), the hole is produced by forming a resist on top of the upper etch stop layer and forming a via hole and trench by etching the multiple layers using the resist, and in step (iv), the resist and the upper etch stop layer are removed when removing the excess of the copper.

40. The method according to Claim 39, wherein the lower etch stop layer, the intermediate etch stop layer, and the upper etch stop layer are formed according to Claim 30.

41. The method according to Claim 39, wherein steps (i) through (iv) are repeated at least once.